Migration and the diffusion of knowledge in a globalized economy

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This paper considers diversity of the knowledge of expats as a complementary dimension of human capital that may generate spillovers. Such, often intangible, knowledge about foreign markets, management skills, and other complementary information may enhance the productivity of these expats, or the people who interact with them. However, due to a lack of knowledge about local culture and language, productivity may also decline. We explore an extensive set of microdata from Statistics Netherlands, and use an augmented Mincer approach to simultaneously identify the private and social returns to the presence of foreign knowledge workers. Private returns are found to be negative and statistically significant, while no evidence for – either negative or positive – social returns is found.

1. Introduction

Since the 1960s, nearly five decades of increased cross-border labor mobility have transformed Europe's cities into a melting pot of cultures. Even though such cultural diversity may result in a mismatch of (social) skills or Babylonian confusion of languages, a variety of knowledge, skills and cultures may also enhance productivity and innovation. In todays integrated world economy, information about foreign markets and value chains may be essential to be successful abroad, or to withstand foreign competition. This paper aims at making a first attempt to identify the size of both the private and the public returns to the presence of foreign knowledge workers in the Netherlands using an extensive set of microdata.

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This paper considers foreign knowledge workers as a special type of highly educated workers, who have certain characteristics that are not captured by education in general. The combination of these characteristics may either increase or decrease the productivity of these workers compared to their native colleagues with similar characteristics. A crucial assumption made in this paper is that such changes in productivity are reflected into wages. We consider the wage differential between a native and a foreign knowledge worker that are the same on all other accounts as the private return to the presence of knowledge workers. As knowledge is to some extent transferrable, it is possible that the productivity of workers that interact with foreign knowledge workers increases due to the exchange of valuable knowledge or skills. In contrast, because of the need for communication and coordination, the presence of foreign workers that are not familiar with local language and culture may also decrease the performance of natives. Such spillovers may take place within firms, but they may also take place within regions, as interactions between people from different cultures are obviously not limited to the work floor. The ceteris paribus wage differential between similar workers that differ only in the number of foreign knowledge workers within the firm (intra-firm spillovers) or region (intra-regional spillovers) where they work is considered to represent the social returns to the presence of foreign knowledge workers.[2] We use the terms expat and foreign knowledge worker as synonyms.

The contents of the remainder of this paper are as follows. The next section discusses theoretical and empirical insights from the existing literature on migration and knowledge spillovers. Section 3 introduces the data and methodology used to identify the private and social returns to the presence of foreign knowledge workers. This section will also present several stylized facts and descriptive statistics. The empirical findings will be presented in Section 4, where augmented Mincerian wage equations are used to estimate the influence of being an expat on the wages of workers, as well as the effect of the presence of foreign knowledge workers in the same firm and region on the wages of other workers. This section shows that private returns are negative and significant, while there are no (net) spillover effects when sufficiently correcting for firm heterogeneity. Section 5 concludes.

[2] A changed productivity level may not be fully transferred through the wages, but could also change the profitability of firms. The latter is, however, not the topic of the present paper.

2. Theories and evidence on diversity and knowledge spillovers

The idea that diversity may have a positive effect on productivity is certainly not new, and translates back to – at least – the seminal work of Jacobs (1969). The concept is traditionally applied on firms, where it is thought that cities with a more diverse sectoral structure provide more opportunities for spillovers between these sectors. Empirical evidence is consistent with this hypothesis (see De Groot et al., 2008, for a meta-analysis). More recently, the concept of Jacobs externalities has been generalized to the context of migration studies, arguing that a diverse mix of languages, cultures and other knowledge is beneficial for productivity. Cox et al. (1991, p. 827) describe this as the "value-of-diversity hypothesis", and put the focus on the potential positive effects that diversity can have for organizations, arguing that heterogeneous groups are more likely to produce a variety of creative ideas than homogeneous groups. Alesina et al. (2000) introduce a model where more variety of human capital increases productivity in a Dixit-Stiglitz production function. In this model, more variety is always better. But is this way of reasoning valid and is more diversity really better? Lazear (1999a) argues that organizational diversity imposes a trade off. While, on the one hand, a firm can benefit from diversity because certain elements of skills and knowledge are specific to ethnicity or culture, on the other hand combining workers from different cultures, legal systems, and languages introduces costs for firms due to conflict. The gains of diversity are determined by the difference between the information possessed by the representatives of different groups, the relevance of that information, and the ability to communicate. One of the goals of a firm operating in todays global economy is thus to optimize the costs and benefits of diversity.

Let us elaborate a bit more on the channels through which the presence of foreign knowledge workers could cause a change in the productivity level of firms. From the literature on diversity, we know that foreign workers may have access to knowledge that is different (and possibly complementary) to that of local workers. As more skilled and knowledgeable workers are more productive, they will most likely earn a higher wage (these are the private returns to their knowledge). To assess the broader impact of such workers on their environment, we borrow from the human capital literature. Rauch (1993) proposes that individuals do not fully capture the benefits from their human capital, and that the average local level of human capital

can thus be considered as a public good. Formal and informal interaction results in the sharing of knowledge, skills and ideas between workers (see Jovanovic and Rob, 1989). As these knowledge spillovers result in a higher (lower) productivity of identical workers in an environment where human capital is relatively abundant (scarce), a wage differential is likely to occur. Citing the work of Jacobs (1969), Lucas (1988) and Rauch (1993) argue that interactions between educated and skilled individuals generate externalities. The extension of this generic work on human capital spillovers to migration studies is a small one, as the knowledge possessed by workers from abroad is likely to be more diverse than that of native workers. In a globalized world, however, there are more reasons why an ethnic diverse workforce could increase productivity. Dekker et al. (2006) show that cultural diversity in the EU restricts international trade, in a way similar to physical distance. As firms – in particular in a small and open economy like the Netherlands – operate on global rather than national markets, the insider information of foreign employees about their home countries is likely to be of high value. Unfortunately, there is little evidence on the micro foundations of local knowledge spillovers through diversity, and studies that find a positive association are often related to diversity of task specific skills or fields of discipline in problem solving, and not to broader diversity in terms of race or gender (see O'Reilly, 1997, for an overview).

While the evidence on the positive effects of diversity is – at best – mixed, empirical evidence has shown that the costs can be very large. As workers with different mother tongues have to communicate in a foreign language, information is lost by definition. Empirical evidence of Vinke (1995) shows that as much as 30 percent of all information can get lost when two non-native English speakers communicate in English.[3] In organizations where communication is important, the presence of diverse languages can therefore be very costly. Language barriers are, however, not the only factor that may reduce productivity in diverse organizations. As culture – which may be defined as fundamental assumptions, values, behavioral norms and expectations, and larger patterns of behavior (Roussou, 1990) – plays a crucial role in group processes, cultural heterogeneity may increase the incidence of

[3] The work of Vinke (1995) is based on the communication between Dutch university lecturers and their students, such that both senders and recipients had a far above average English language proficiency. The average amount of information loss is thus likely to be even higher than the estimated 30 percent.

misunderstanding, tension, and conflict. Social categorization may also provide an explanation for increased conflict in heterogeneous organizations (for example, O'Reilly, 1997). This concept from social sciences (see Hogg and Abrams, 1988) assumes that individuals have a need to classify themselves on characteristics such as ethnicity, gender and age. It has been shown that being different is generally considered as a deficiency, while people that are (by self categorization) perceived as similar are seen as more trustworthy, honest, and cooperative (Brewer, 1979, Tajfel, 1982, and Loden and Roserer, 1991). Dekker et al. (2006) show that cultural distance is strongly related to trust. Empirical evidence has shown negative associations between heterogeneity and conflict (Jehn, 1997), absenteeism (Tsui et. al., 1992) as well as a less open communication and more distortion of messages (Rogers and Bhowmik, 1971). [4] As a result of this, productivity is likely to decrease. The theoretical and empirical evidence presented above strongly supports the tradeoff theorem of Lazear (1999a): in order to receive net benefits from diversity it is very important for organizations to optimize diversity in area's that provide maximum opportunity for knowledge spillovers – and thus productivity gains – while minimizing the negative effects of diversity it in other areas. O'Reilly et al. (1997) investigate 32 project teams from a large corporation with a highly diverse work force, and find a positive effect of diversity on group performance, but an even larger negative effect due to increased conflict. This indicates that the net effect of diversity can easily become negative.

Apart from the diverse literature on the micro foundations of the relation between diversity and productivity (mostly originating from the social and organizational sciences), economists have produced a large literature that attempts to estimate this association in a more direct manner. This literature often models the effects of migrants on wages through supply and demand – for example by assuming that foreign and native workers with similar education and experience are either perfect substitutes (Card 2001, Borjas 2003), or imperfect substitutes (Ottaviano and Peri, 2005b). This approach, however, ignores the fact that migrants may not only change the price of distinct types of labor, but may also affect productivity itself. Ottaviano and Peri (2005a) find that cultural diversity in American cities is associated

[4] A distinct, but related example of the impact of diversity on social interactions is provided by Landes and Michael (1977), who show that divorce is more likely for couples from different cultures, languages or religions.

with substantially higher wages in diverse cities compared to relatively homogeneous cities. For European regions in 12 countries, Bellini et al. (2008) find that cultural diversity is positively related to productivity. Many recent studies on the returns to diversity have been using country level, or regional data (for example, Easterly and Levine, 1997, Glaeser, Scheinkman, and Shleifer, 1995, Ottaviano and Peri, 2005a, and Bellini et al., 2008). A disadvantage of this type of data is, however, that it is very difficult to control for unobservable heterogeneity or to find suitable instrument variables when using panel estimations. This type of research is therefore likely to run in to reverse causation problems: as foreign workers do not have an existing bond with a certain region in a destination country, they are more likely to locate themselves in regions with a high level of wages and productivity (see Manski, 1993, for a discussion of some of the problems related to the identification of social interactions). Another pitfall in estimating the returns to diversity is related to migrant heterogeneity. Even though the present literature has extensively addressed the fact that the effects of foreign workers are heterogeneous across different groups of native workers (see, for example, Ottaviano and Peri, 2005b), it is also plausible that different types of migrants have a different effect on native wages. The current literature tends to focus on the effects of migration in general, albeit acknowledging differences in terms of education, gender and age. The reality is, however, that 'the migrant' as such does not exist, but represents a heterogeneous mix ranging from highly skilled expats to refugees from war zones and illiterate migrants from low-income countries. Not addressing this issue thus implies that an engineer from Canada working for an American university is expected to have the same effect on wages as an engineer who fled a war zone and is now working as a cleaner. As the composition of migrants present in the U.S. is very different from that in Europe, it is well possible that the net effects of migration are very different as well. Not sufficiently correcting for this type of heterogeneity is likely to result in econometric estimates that are not robust. We therefore focus on just one type of migrants: knowledge workers from advanced economies. As we have seen that the most likely cause of a positive productivity effect of diversity would be the contribution of valuable knowledge, either directly or through knowledge spillovers, we expect that the probability to find such effects is the highest among high skilled foreign knowledge workers. Additionally, higher educated workers are likely to have a higher ability to learn

foreign language and the basics of a different culture, which reduces the costs of ethnic diversity.

3. Data and methodology

The empirical goals of this paper are twofold: the first is to estimate the productivity effect of foreign knowledge workers through wages; the second is to identify the channels through which knowledge is transferred. If there is a productivity effect, there are several possible scenarios. First, it may be that knowledge is not transferred at all. In the absence of knowledge spillovers, the rents of knowledge possessed by a foreign knowledge worker are shared between the firm and the employee. We thus expect that knowledge workers earn a higher wage than similar, native, workers within the same firm, while there is no difference between native workers in that firm and workers in similar firms with a less expats. A second scenario is that knowledge spillovers do exist, but that they occur solely within firms. In that case, we expect that a foreign knowledge worker does still have a higher income than native workers within the same firm, but also that these native colleagues earn more than their counterparts in similar firms that differ only in the share of foreign knowledge workers. As native workers who gained from expats may switch jobs to other firms, and as relevant knowledge may be transferred during contacts with other professionals outside the firm, it is also possible that the region as a whole, or possibly even an entire country, benefits from the presence of foreign knowledge workers.

Starting with the work of Easterly and Levine (1997), economists have attempted to estimate the effects of ethnic diversity on economic performance using cross-country data. As is argued by, for example, Bellini et al. (2008), the use of a more disaggregated spatial level seems more appropriate as interactions between individuals are far more likely to occur within cities. We propose to go one step further. Because the exchange of knowledge that is relevant for the productivity of workers is even more likely to occur on the work floor, the most straightforward level of aggregation is that of the firm. Not only do workers spend a large share of their time on the work floor, it is also likely that conversations that take place within firms are more often work related compared to talks with family, friends or neighbors. In addition to this, colleagues – being insiders – are far more likely to be in the

possession of skills or knowledge that are relevant. Valuable ideas or best practices are often documented within firms, and their exchange is facilitated, whereas the same firms tend to create barriers to prevent their competitors to benefit. Even though we fully acknowledge that a part of all knowledge spillovers may take place within cities or regions, we argue that if any spillovers exist, the first place to look for them is within firms. Canton (2009) uses microdata to test whether a higher presence of highly educated individuals in firms or regions results in knowledge spillovers. He finds a positive and significant relation on the regional level, but it disappears when the firm's knowledge stock is included (Canton, 2009). As we have seen in Section 2, the most likely channels through which the presence of knowledge workers could increase productivity are all related to some sort of knowledge transfers, such that these findings have implications for the diversity literature as well.

This paper uses the 2000–2008 cross sections of the Dutch labor force survey, combined with complementary data originating from tax-records to construct a linked employer-employee database. It is important to note that our data includes only workers who pay taxes in the Netherlands, and who currently have an address in the Netherlands. Our results do thus not apply to expats who are send abroad while still being paid in their home countries. We use pre-tax real hourly wages of individual workers and jobs as main indicator for productivity. The Dutch labor force survey does not include data on wages. Instead, we calculate hourly wages by taking the quotient of the annual fiscal wage from tax data and the number of hours worked from the labor force survey. The consumer price deflator of Statistics Netherlands has been used to correct for inflation. Our identification strategy is to estimate augmented Mincerian wage regressions (after Mincer, 1974), where the natural logarithm of hourly wages is explained by a set of individual worker characteristics, extended with data on the firm and region where each employee works. For each employee we included data that is related to human capital, such as age, gender, level of education, job type (we use the 2-digit ISCO occupation), the firm where he or she is occupied, the corresponding industry (at the 2-digit NACE rev. 1.1 level), country of birth, the number of hours worked, and work location. The work location is defined as the municipality where the job site or business unit of each individual worker is located. As we focus on a very specific type of migrant, we use four criteria to operationalize what we consider foreign knowledge workers from advanced economies. Foreign knowledge workers must have been born in a country with a nominal GDP per capita

in 2010 of at least 20,000 US$[5], they must have successfully completed higher secondary education or tertiary education, they must be between 30 and 60 (to exclude foreign students), and their observed job must have generated an income of at least 10,000 euros (thus excluding both low paid jobs and jobs with a short duration). In our wage regressions, we include only workers that comply with these criteria, except – for natives – country of birth (such that we compare individuals that are as similar as possible on all other accounts), and we exclude all workers earning in excess of 10 times the median wage.[6] Including dummies for foreign knowledge workers (combined or for separate countries of origin) should capture the private returns to the human capital possessed by foreign knowledge workers that is in excess of their general human capital.

All variables related to firms and municipalities – these are total employment and two indicators for the presence of migrant knowledge workers – are constructed directly from the microdata. As the labor force survey has only about 50,000 observations annually – which implies that for a middle-sized firm with 100 employees only 1 employee is expected to be included, we use tax data for this purpose. Because the level of education is not available through this dataset, we have to exclude it from our definition of expats. The first indicator is the share of migrant knowledge workers:

$$share_{r,t} = \frac{\sum_{c}\left(migr_{r,t}^{c}\right)}{employment_{r,t}}, \qquad (1)$$

calculated as the sum of migrant knowledge workers from all countries c in region r and year t, divided by total employment in that region. For municipalities, the share of foreign knowledge workers ranges from 0.4 percent to just over 10.1 percent. This measure does not differentiate between knowledge workers from different countries.

[5] According to the World Economic Outlook Database of the International Monetary Fund these include Luxembourg, Norway, Qatar, Switzerland, Denmark, Australia, Sweden, the United Arab Emirates, the United States, The Netherlands, Canada, Ireland, Austria, Finland, Singapore, Belgium, Japan, France, Germany, Iceland, the United Kingdom, Italy, Kuwait, Hong Kong, New Zealand, Spain, Brunei, Cyprus, Greece, Israel, Slovenia, Portugal, The Bahamas and South Korea.

[6] Because of the limited sample size, the number of individuals earning very high incomes is very small. As a precaution, we exclude these workers.

As we know from the discussion in Section 2 of the micro foundations of the spillovers from diversity, however, a heterogeneous mix of foreign knowledge workers can be expected to have a higher potential for spillovers than a homogeneous mixture. Not only because the knowledge of migrant workers can be specific to different foreign markets or cultures, but also because the productivity of – say – a US worker in a Dutch firm could benefit from knowledge possessed by a German coworker. Therefore, we use the fractionalization index as an additional measure, which is a standardized measure for diversity. Following the work of Mauro (1995), this index is widely used to capture the probability that two individuals randomly selected from a set of different groups belong to the same ethnic group. It is defined as 1 minus the Herfindahl index on the shares of each country in the region, or formally

$$frac_{r,t} = 1 - \sum_{c} \left[\frac{migr_{r,t}^{c}}{employment_{r,t}} \right]^2 . \qquad (2)$$

The fractionalization index is calculated using foreign knowledge workers only, rather than foreign employees from all countries. Expressions (1) and (2) are also used to calculate the share of expats and the fractionalization index for firms. Their inclusion in different variations of the Mincer equation is expected to capture the social returns to the presence of expats. For municipalities, the fractionalization index ranges from 0.009 to 0.183.

Before we continue with the econometric analyses in the next section, we present some stylized facts about our data, paying special attention to the differences between expats and native workers. Table 3.1 shows (both hourly and annual) average wages, hours worked, the share of males, the share of highly educated workers, and the average age for three groups of employees; workers that were born in the Netherlands, workers that were born in one of the countries specified in footnote 5, and workers that were born in any other foreign country. It is important to note that the labor force survey is not fully representative on some characteristics, like gender, such that the figures presented in Table 3.1 reflect the composition of our data set rather than the composition of the Dutch labor market.

Table 3.1. Stylized facts

	Native Dutch employees	**Foreign knowledge workers**	**Other foreign workers**
Number of observations	326,042	6,739	20,500
Average hourly wage	20.94	21.57	16.85
Average hours worked	1,723	1,732	1,762
Average annual wage	36,077	37,359	29,698
Share of males	55.7%	48.8%	52.8%
Share of highly educated*	37.5%	40.9%	27.7%
Average age	45.0	43.8	43.9

* Defined as workers with at least higher tertiary education (Dutch: HBO).

The wages of foreign knowledge workers are not very different from those of native workers. They earn somewhat higher annual wages, but this 3.6 percent difference is almost fully explained by the 2.8 percent difference in hours worked. In addition to this, foreign knowledge workers are somewhat younger than native workers, higher educated, and – surprisingly – more often female. The rightmost column of Table 3.1 shows that foreign workers that were born in low and middle-income countries are, however, very different from both their native-born colleagues and those born in advanced economies. On average, they are less well educated and are paid far lower wages. Because the differences between foreign workers from advanced economies and other foreign workers are relatively large, it is well possible that our group of foreign knowledge workers is still rather heterogeneous (even though it is limited to high income countries). Table 3.2, which presents annual and hourly wages for separate countries of birth, shows that this is indeed the case. Employees born in New Zealand earn over 70 percent higher hourly wages than those from Portugal.

Table 3.2. Stylized facts by country of origin

Country of origin*	Number of observations	Average hourly wage	Average annual wage
Native Dutch employees	326042	20.94	36,077
Foreign knowledge workers	6739	21.57	37,359
Other foreign workers	20500	16.85	29,698
Portugal	211	15.45	27,360
Greece	132	17.63	30,317
Hong-Kong	136	18.59	31,450
Spain	311	19.33	33,743
Germany	1,815	20.02	33,760
Australia	259	20.21	34,503
Italy	249	20.52	37,426
Japan	31	20.85	38,076
Singapore	50	21.17	39,310
Israel	46	21.21	39,930
Finland	26	21.23	33,473
France	385	21.53	35,987
South-Korea	41	21.81	38,569
Belgium	1,017	22.07	37,378
Norway	46	22.44	39,076
Austria	130	22.44	39,833
Canada	264	22.61	38,531
Switzerland	117	23.05	39,804
Luxembourg	21	23.39	46,518
Sweden	74	23.83	42,136
Great-Britain	884	24.96	45,268
Denmark	64	25.08	44,216
United States	286	26.17	46,032
New-Zealand	107	26.34	47,155

*Data is only presented if the number of observations is at least 20.

4. Results

This section presents the results of various estimations of the Mincerian wage regression. Hereby, we use the following basic econometric specification,

$$\log(w_{i,f,r,t}) = \alpha + X_{i,f,r,t}\beta + \gamma F_{f,t} + \lambda R_{r,t} + d_f + d_t + \varepsilon_{i,f,r,t} \,, \qquad (3)$$

where the natural logarithm of the pre-tax real hourly wage w of employee i in firm f and region r in year t is explained by a constant, a matrix X with individual worker characteristics, a matrix F with firm characteristics and matrix R with region characteristics that vary over time, optional firm fixed effects d_f, and time fixed effects d_t, and a residual term. Because the presence of foreign knowledge workers in

a firm is likely to be correlated to their presence in the region, we have divided the share respectively fractionalization index for firms by that of the regions where they are located. Results are presented in Table 4.1. All specifications include the age of workers, age-squared, gender, whether a worker is part-time employed or not (this may be important, as Ducht natives often work in part-time jobs that are relatively less paid, whereas this may be different for foreign workers), as well as a set of education dummies (to account for both the quality and the quantity of education). Because we include only workers with at least higher secondary education in our estimations, this represents the omitted category. Variables that indicate whether a worker is a foreign knowledge worker, or a foreign worker from another country, are included in all specifications as well, as are year dummies. Specifications (1), (3) and (5) estimate the effects of the share of expats as indicator for the presence of foreign knowledge workers, whereas (2), (4) and (6) use the fragmentation index. Specifications (1) and (2) include industry dummies and firm size to correct for firm heterogeneity. Specifications (3) and (4) use firm fixed effects for this purpose, thus allowing us to fully correct for all time invariant firm heterogeneity. In this case, the effect of the stock of foreign knowledge workers in firms is thus estimated on time variation. Because it is possible that foreign knowledge workers have different wages relative to natives because they have a different type of occupation within the same firm, we included occupation dummies in specifications (5) and (6). The approach used in this paper is similar to that of Groot et al. (2011), who use augmented Mincer regressions to estimate the effects of agglomeration on wages and productivity.

Table 4.1. Results (dependent variable: log of individual wage)

	(1)	(2)	(3)	(4)	(5)	(6)
Age	0.044	0.044	0.042	0.042	0.037	0.037
	(36.5)	(36.5)	(35.5)	(35.5)	(32.8)	(32.8)
Age-squared	–0.0004	–0.0004	–0.0004	–0.0004	–0.0003	–0.0003
	(28.0)	(28.0)	(26.9)	(26.9)	(24.3)	(24.3)
Female	–0.118	–0.118	–0.115	–0.115	–0.111	–0.111
	(53.6)	(53.6)	(52.0)	(52.0)	(51.2)	(51.2)
Part-time	–0.080	–0.080	–0.066	–0.064	–0.043	–0.043
	(36.4)	(36.4)	(30.3)	(30.3)	(20.3)	(20.3)
*Education dummies**						
Lower tertiary education (MBO 2 + 3)	0.084	0.084	0.072	0.072	0.033	0.033
	(32.1)	(32.1)	(27.2)	(27.2)	(13.1)	(13.1)
Lower tertiary education (MBO 4)	0.117	0.117	0.100	0.100	0.060	0.060
	(34.5)	(34.5)	(29.7)	(29.7)	(18.3)	(18.3)
Higher tertiary education (HBO, BA)	0.303	0.303	0.277	0.277	0.164	0.164
	(117.1)	(117.1)	(103.9)	(103.9)	(60.0)	(60.0)
Higher tertiary education (MA, PhD)	0.510	0.510	0.470	0.470	0.332	0.332
	(169.7)	(169.6)	(151.5)	(151.5)	(101.0)	(101.0)
Variables on foreign knowledge workers						
Foreign knowledge worker	–0.062	–0.061	–0.051	–0.051	–0.043	–0.043
	(10.1)	(10.0)	(8.5)	(8.5)	(7.6)	(7.6)
Other foreign worker	–0.175	–0.175	–0.141	–0.141	–0.102	–0.102
	(44.8)	(44.8)	(36.3)	(36.3)	(27.4)	(27.4)
Log firm size (employees)	0.015	0.015				
	(23.9)	(23.6)				
Relative share of expats in the firm	0.009		0.004		0.004	
	(10.6)		(2.5)		(2.5)	
Rel. frac. of expats in the firm		0.010		0.005		0.005
		(9.8)		(2.6)		(2.6)
Log region size (employees)	0.003	0.003	–0.002	–0.002	–0.004	–0.003
	(3.7)	(3.6)	(1.5)	(1.6)	(3.1)	(3.2)
Share of expats in the region	1.876		1.838		1.669	
	(22.2)		(11.5)		(10.9)	
Fractionalization of expats in the region		0.990		0.968		0.879
		(22.4)		(11.6)		(11.0)
Industry dummies	yes	yes				
Occupation dummies					yes	yes
Year dummies	yes	yes	yes	yes	yes	yes
R^2	0.319	0.319	0.270	0.270	0.323	0.323
Number of observations	204,330	204,330	204,330	204,330	204,330	204,330

Note: *t*–statistics (in absolute values) are reported between parentheses. *Categories denote the highest qualification obtained. Omitted category: individuals with at most higher secondary education.

We find that individual worker characteristics provide a strong explanation for differences in payment. In equations (1) to (4) – when not including occupation dummies – we find coefficients that are fairly comparable to those found by Groot et al. (2011), who also rely on the Dutch labor force survey and tax data, and the values that are generally found in the literature. The results are robust across different

specifications. When we correct for occupation, however, these fixed effects take away part of the estimated returns to education. Obviously, this is because occupation is endogenous and largely dependent on education (and, for that matter, ability). The inclusion of occupations would be especially important if we would find strong private returns for expats, because this finding could be explained by their overrepresentation in highly paid occupations. However, the expat dummies in specifications (5) and (6) change little relative to those in (3) and (4). In all specifications, the private returns to being a foreign knowledge worker are negative. This implies that foreign knowledge workers earn lower wages than their native colleagues that are comparable on all other (observed) characteristics within similar firms – specifications (1) and (2) – or the same firm. The relatively strong relation between firm size and wages may be explained by efficiency wage theory (Akerlof, 1982). In order to attract and retain the most productive employees, large firms pay relatively high wages. Even though it is possible that negative private returns coexist with positive social returns, because even if expats are less productive than native workers that does not necessarily exclude the possibility that they may improve the productivity of other workers trough knowledge spillovers[7], it makes the existence of positive spillover effects far less likely. Even though specification (1) and (2) show a positive and significant effect of both the share of foreign knowledge workers and fractionalization on the wages of other workers within the same firm, this effect disappears when we control for firm fixed effects in specifications (3) to (6). This implies that the effects found under specification (1) and (2) were in fact not due to the presence of expats, but because firms with a high share of expats are different for other reasons (for example, they may be multinationals). In all specifications, the share of foreign knowledge workers and the fractionalization index calculated from their presence yield very similar econometric results. This indicates that the mix of expats is not very important. For municipalities, the presence of (different groups of) foreign knowledge workers is strongly associated with wages. The high coefficient is the result of the fact that their presence is generally very low, whereas it is much higher in a few large agglomerations. At the same time, these agglomerations are characterized by relatively high average wages that are not well explained by human capital. It is thus very likely that the coefficients on the municipality level are due to

[7] It is also possible that foreign knowledge workers are discriminated on the labor market, such that they receive lower payment given their level of productivity.

unobserved heterogeneity. As Groot et al. (2011) show, economic density and sectoral specialization provide a partial explanation for regional wage differences that remain after correcting for differences in human capital.

As we have seen in Section 3, foreign knowledge workers from advanced economies are still a rather heterogeneous group in terms of average wages. Our econometric specification allows us to include separate dummies for expats from different countries as opposed to a single combined dummy. Table 4.2 shows the estimates of these dummies – again for all countries with at least 20 observations, using specification (3) as a basis.

Table 4.2. Expat dummies by country of origin

Country of origin*	**Coefficient**	**t-statistic**
Singapore	–0.179	(2.9)
Italy	–0.144	(4.5)
Luxembourg	–0.135	(1.1)
Japan	–0.131	(1.4)
France	–0.110	(4.6)
Greece	–0.108	(2.3)
Hong-Kong	–0.095	(1.7)
New-Zealand	–0.094	(2.2)
Portugal	–0.093	(2.3)
Sweden	–0.090	(1.7)
Israel	–0.089	(1.4)
United States	–0.076	(2.8)
Switzerland	–0.070	(1.8)
Spain	–0.059	(2.1)
Australia	–0.047	(1.5)
Great-Britain	–0.043	(2.7)
Germany	–0.041	(3.6)
Austria	–0.032	(0.7)
Norway	–0.022	(0.3)
Belgium	–0.014	(1.0)
Canada	–0.006	(0.2)
Finland	0.007	(0.1)
Denmark	0.041	(0.7)
South-Korea	0.111	(1.5)

Note: *t*–statistics are in absolute values. *Omitted category: native Dutch workers

Even though the results show a large heterogeneity, no clear pattern emerges. Almost none of the estimated destination country dummies are significant, and even when they differ significantly from Dutch workers the differences between countries are never significant. It is thus not the case that we find positive private returns for knowledge workers from some countries, whereas negative for those from other

countries. Furthermore, we find that the heterogeneity in average wages presented in Table 3.2 is largely a reflection of differences in the composition of expats from different countries: foreign workers born in the United States are much higher educated than those from, for example, Portugal.

5. Conclusions

The question addressed in this paper is whether the presence of foreign knowledge workers generates social returns that are in excess of the private returns harvested by the foreign workers themselves. All returns are measured in terms of wages, where it is assumed that wages are at least partially the reflection of productivity differences. Hereby, we consider the knowledge and skills possessed by foreign knowledge workers – or expats – as a special dimension of human capital that is not captured by generic education.

Section 2 starts by taking the micro foundations of the effects that diversity can have on productivity and group processes in consideration. It emerges that the most likely channel for positive effects of diversity on productivity are trough knowledge spillovers. Therefore, we briefly discuss the literature on knowledge spillovers as well. Contrary to popular belief, the micro foundations for positive diversity effects are in fact not strong. Evidence on positive effects is mixed, whereas the downsides of diversity have been shown to have rather strong negative effects on productivity. Diversity tends to reduce the ability of workers to cooperate, because it causes miscommunication, misunderstanding and conflict. Studies that attempt to separate the positive and negative effects of diversity have found that the net effect is often negative (Lazear, 1999a and 199b, O'Reilly, 1997). Because theory predicts that knowledge spillovers are the most plausible source for positive diversity effects, and as migrants in general are an extremely heterogeneous group – as becomes clear during the discussion of our descriptive statistics in Section 3, differences between migrants differing in country of birth are in fact much larger than those between migrants from advanced economy and natives – our research focuses on a specific type of migrants; foreign knowledge workers from advanced economies. We expect that this group is more likely to be in the possession of valuable knowledge (as opposed to, for example, an illiterate migrant from a low income country), whereas migrants from advanced economies tend to have a better understanding of the English

language (which in The Netherlands serves as a lingua franca for communication with those who do not speak Dutch) and may be more familiar with western culture. For foreign knowledge workers from advanced economies, the probability that positive spillovers from diversity will out weight the costs of diversity is thus more likely than for other groups of migrants.

In Section 4, we use augmented Mincerian wage regressions to estimate the effect of being an expat on the individual wage, correction for many other characteristics of individual workers. We also include the share of expats in the region where each employee works, as well as the share of expats in the firm where he is employed relative to that in the region, to measure the social returns to the presence of foreign knowledge workers. Our findings suggest that foreign knowledge workers earn lower wages relative to comparable natives in the same firm. We find no evidence for any – positive or negative – association between the presence of foreign knowledge workers in firms and the wages of other workers in the same firm. Even though we do find a rather strong effect on the regional level, this is most likely the result of not fully accounting for unobserved heterogeneity. We argue that if foreign knowledge workers would contribute – ceteris paribus – more to the productivity of a firm than natives, this would most likely be reflected in higher wages for these workers. After all, firms can improve their level of productivity by hiring them, which would result in increased demand and thus higher wages. Even though it is possible that positive social returns to the presence of foreign knowledge workers coexist with negative private returns, such effects should be observable on the firm level. From the fact that we do not find such an effect, we thus conclude that it is very unlikely that any positive spillovers from diversity exist.

It is important to keep in mind that the question addressed in this paper is not necessarily the equivalent of the question whether the presence of expats in a region is good or bad. Even though foreign knowledge workers earn – on average – somewhat lower hourly wages after correcting for observed human capital, they are often relatively highly educated and work longer hours. Our findings thus do not conflict with the hypothesis from the diversity literature that the presence of migrants may increase productivity. What seems to be the case, however, is that such positive productivity effects do not arise because of diversity, but rather despite diversity. We suspect that positive effects from the presence of foreign workers arise particularly when they have a higher level of human capital than the average for the destination

country, because highly educated workers in general are beneficial for productivity and because the supply of foreign knowledge workers saves the costs of education.

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